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CHARACTERIZATION OF CLAY FROM THE CASSIDY LAKE SILICA DEPOSIT, SOUTHERN NEW BRUNSWICK

D. V. Venugopal

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Abstract

Clay occurs in association with a silica deposit near Cassidy Lake in southern New Brunswick. Samples were selected and analysed for their physical and chemical properties to determine possible end uses.

The study indicated that the clay-size fraction is a mix of extremely fine, poorly crystallized, iron-rich kaolin and silica flour. The kaolin has very poor processing characteristics and is difficult to beneficiate into a high-value end product.

Résumé

De l'argile est associée à un gîte de silice près du lac Cassidy, dans le Sud du Nouveau-Brunswick. On en a sélectionné des échantillons et on a analysé leurs propriétés physiques et chimiques pour déterminer ses utilisations finales possibles.

L'étude a révélé que la fraction granulométrique colloïdale d'argile constitue un mélange de farine de silice et de kaolin riche en fer légèrement cristallisé et extrêmement fin. Le kaolin se prête très mal à un traitement et il est difficile d'en tirer un produit final de grande valeur.

Characterization of Clay from the Cassidy Lake Silica Deposit, Southern New Brunswick

Introduction

Clay is known to occur in association with a silica deposit near Cassidy Lake (Atlantic Silica Inc., Lockhart, 1983, 1984 and 1988), however, limited information is available concerning its characteristics, extent and potential end uses. In 1995, three samples of clay-bearing material, consisting of two grab samples from surface exposures and one from the bottom of a settling pond were collected. These were sent to I.M.D. Laboratories Limited for a determination of their suspected kaolin content and to evaluate the materials physical and chemical properties. The methodology and the results of this investigation are detailed in the appendix of this report.

Location and deposit access

Clay is found in association with a quartzose sand and gravel deposit that is located 4 km northeast of Cassidy Lake and about 10 km south of the Town of Sussex in southern New Brunswick (Figure 1), and extends over an area of 140 ha. The silica resource is presently being developed by Atlantic Silica Inc. Excavating from a large pit, Atlantic Silica processes sand and coarser-grained fractions of the pit-run material into several products that are marketed throughout the region. The finer-grained silica- and clay-bearing fractions are accumulated in a tailings pond disposal area adjacent to the operation. Access to the Cassidy Lake deposit and the Atlantic Silica operation is by a network of secondary, chip-sealed roads that connect with Highway # 111 to the east, Highway # 865 to the west and Highway # 1, a major four-lane highway about 15 km to the north. An active rail spurline linking a nearby potash processing facility to the main Canadian National Railway line is situated less than 5 km to the west of the Cassidy Lake deposit.

Geology

Figures 1 and 2 give the general and regional geology of the Cassidy Lake silica-clay deposit (McLeod *et al.* 1994; St. Peter1995). The deposit occurs in a down-faulted block on the south side of the Clover Hill Fault, which is a major northeast-trending structural feature in the region. The fault separates the coarse-grained clastic rocks of the Horton Group (Memramcook Formation) of Late Devonian to Lower Carboniferous age to the north from the younger finer-grained clastics of the Mabou Group to the south (St.Peter 1995). The clay and siliceous deposits are considered to be of Cretaceous age (Fensome and Venugopal, in preparation) and unconformably overlie Mabou rocks.

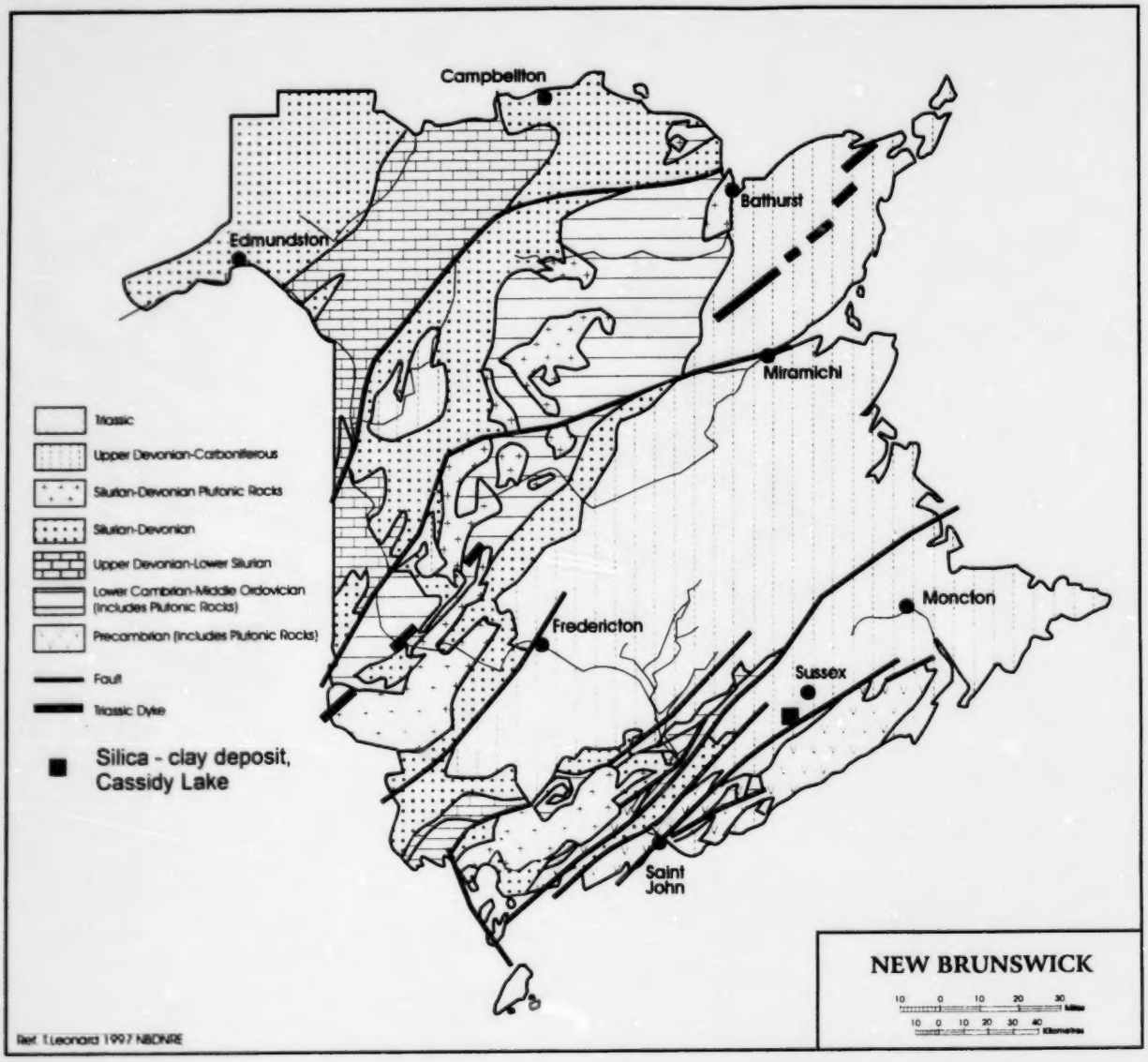
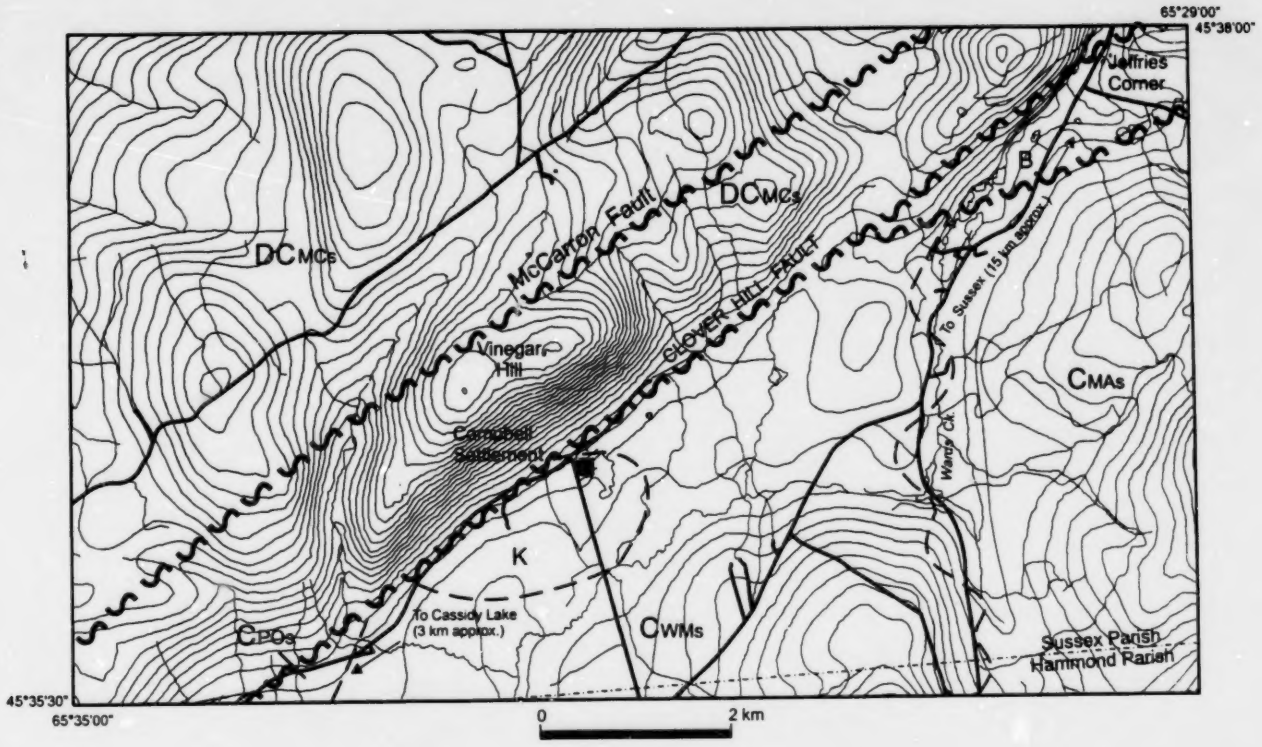


Figure 1. Regional geology and location map of the silica - clay deposit, Cassidy Lake area.



LEGEND

CRETACEOUS OR OLDER

K — Poorly consolidated, white, quartz-rich sandstone and conglomerate with siliceous and clayey matrix; minor lenticular beds of kaolin

LOWER CARBONIFEROUS

MABOU GROUP

CMAs — Undivided, reddish brown to red, polymictic conglomerate, quartzo-feldspathic sandstone and mudstone with locally well-developed calcrete; minor, greenish grey mudstone and sandstone

CWMs — WANAMAKER FORMATION: Reddish-brown, polymictic conglomerate and sandstone

CPOs — POODIAC FORMATION: Greyish brown, fine-grained sandstone and reddish brown mudstone

UPPER DEVONIAN - LOWER CARBONIFEROUS

HORTON GROUP

DC MCs — MEMRAMCOOK FORMATION: Red to grey, granule to boulder, polymictic conglomerate and fine-grained to pebbly sandstone with sparse plant material; red mudstone and minor calcrete

PRE-CARBONIFEROUS

B — Deformed to polydeformed sedimentary, volcanic, and metavolcanic rocks; massive to deformed intrusive rocks

SYMBOLS

Fault

Geological contact (approximate)

Cassidy Lake silica-clay deposit

Figure 2. Regional geology of the silica-clay deposit, Cassidy Lake area, Campbell Settlement, southern New Brunswick. (after McLeod *et al.*,1994; St.Peter, 1995)

Overburden in the area of the deposit varies from 1 to 15 m in thickness and consists of a mixture of mostly red silty gravel and minor red to brown clay.

Quartzose sand and gravel are major constituents of the deposit. Clay is a relatively minor component occurring as a matrix combined with varying amounts of silica flour, and as thin, (up to 60 cm thick) lenses enclosed by coarser-grained siliceous material.

Sampling

During preliminary examination of the white silica-rich sand and gravel resource, varying amounts of a clay-like substance were reported in several drill holes. Due to the poor recovery of the fine-grained and suspension-size fractions from these holes, there remains very limited information on the nature of the occurrence and its characteristics.

The samples for this characterization study were restricted to three, 10 kg batches of the siliceous clay material representative of pit-run material and material from a tailings pond area associated with the silica processing facility. The location of sample sites is indicated on Figure 3 (in pocket). The following is a brief description of samples referred to in the appended report entitled "Characterization of three kaolin-containing samples, I.M.D. Project #95003".

ASL-1: Sample obtained from the footwall near the east end of the pit. The clay-bearing material is light grey to greyish white in color and appears to display a fair amount of plasticity.

ASL-2: Sample from the central part and bottom of a tailings pond located near the northwestern extremity of the pit (sample was obtained during the fall-winter season when the surface of the pond was frozen). The sample was in the form of thick slurry, which probably contained silica flour. It displayed a light greyish white to light rusty brown coloration.

ASL-2A: Sample from the southwestern part of the pit. The clay was taken from a lenticular bed enclosed by a coarse-grained sand to a cobbly gravel. The clay was light greyish to rusty brown in color with a moderate to high degree of plasticity.

Conclusions

Three grab samples of an admixture of clay and fine-grained silica were acquired from the silica operation of Atlantic Silica Inc. (the Cassidy Lake silica deposit) near Campbell Settlement in southern New Brunswick. These samples were

subjected to a characterization study to determine their physical and chemical properties, processing alternatives and potential end use(s) (I.M.D. Laboratories Limited 1995).

The study concluded that: 1) kaolin dominated the clay fraction; 2) the particle size of the kaolin is extremely fine; 3) the clay particle size overlaps that of the associated silica; 4) the kaolin has poor processing characteristics in regard to crystallinity and flocculation, and 5) effective and complete separation of the kaolin and silica could not be accomplished by either vacuum or pressure filtration.

It was further concluded that even if the difficulties in concentrating the clay fraction could be overcome, the resulting products would probably have a very limited range of industrial end uses with brick manufacturing and/or pottery being most likely.

Acknowledgements

The review and suggestions offered by coworkers in the Geological Surveys Branch are greatly appreciated. Special thanks to Barb Carroll; Ken Mersereau and Terry Leonard for editing and preparing the maps and figures.

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APPENDIX 1

The Characterization of

Three Kaolin-containing Samples

I.M.D. Project # 95003

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July 5, 1995

The New Brunswick Department of
Natural Resources and Energy,
P.O. Box 6000
Fredericton, New Brunswick
E3B 5H1

Attention: Mr. D.V. Venugopal

Dear Mr. Venugopal,

Enclosed please find 2 copies of our report entitled:

CHARACTERIZATION OF THREE KAOLIN CONTAINING SAMPLES.

Please contact us if you have any questions or concerns.

Yours truly,

J. Kriens
President
I.M.D. LABORATORIES LTD.

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CHARACTERIZATION OF

THREE KAOLIN CONTAINING SAMPLES

I.M.D. PROJECT #95003

STUDY CONDUCTED FOR:

THE NEW BRUNSWICK DEPARTMENT
OF NATURAL RESOURCES & ENERGY
FREDERICTON, NEW BRUNSWICK

REPORT PREPARED BY:

J. KRIENS
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MARCH 2, 1995

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1.0 INTRODUCTION

A basic material characterization study was conducted on three kaolin containing samples, originating from a silica sand processing operation.* Two of the samples were obtained from a tailings pond being the waste associated with the silica, while the third sample originated as a lenticular lens of kaolinitic material in the silica deposit.

The samples were submitted by Mr. D.V. Venugopal of the Department of Natural Resources and Energy, Fredericton, New Brunswick.

The material characterization program was conducted as per Phase I and part of Phase II of the proposed evaluation program.

This report outlines the findings based on results and observations made during the study.

All results obtained and observations made are based on the "as received" samples only.

* This should read as follows..."Two samples were obtained from separate locations within an excavation (pit) adjacent the processing facility while a third sample was collected from the bottom of a tailings disposal pond."

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2.0 SUMMARY

From the results and observations it is clearly evident that the kaolin, as contained in the submitted samples, is an extremely fine, poorly crystallized iron rich kaolin.

The kaolin is associated with very fine silica, its particle size overlapping the particle size of the kaolin. Even after making separations from silica at 10 micron, the kaolin still contains significant amounts of silica which is finer than 10 micron.

The kaolin has very poor processing characteristics. After separation at 325 mesh (45 micron) of the kaolin containing fraction from the silica sand, the resulting -45 micron kaolin slurry could not be readily flocculated, using either the typical inorganic flocculating process based on the use of sulphuric acid to reduce pH to 2.6 and addition of alum (aluminum sulphide), or by using organic flocculants.

As a result of the poor flocculating characteristics, extreme fineness and poor crystallinity of the kaolin, it was virtually impossible to filter the kaolin containing slurry by either vacuum or pressure filtration. Filter times by pressure filtration at 80 $lb/inch^2$ were as high as 48 hours for 5 litres of slurry.

As it is virtually essential to separate the kaolin from the silica sand with a wet process, the subsequent difficulties in processing the kaolin containing slurry will result in an uneconomic process.

Even if the material could be readily processed i.e. by flocculation, filtration and drying, the resulting products would have very limited scope for industrial uses.

If processing difficulties could be overcome by virtue of more extensive testing to resolve these programs, the resulting products would possibly only be useful in applications such as brick making or clay pots.

The one possible alternative, which would only apply to the "in situ" kaolin rich lenses, may be by breaking up the kaolin rich material by drying and grinding in a roller mill, followed by air classification to extract a fine kaolin rich kaolin-silica mixture. It may be of interest to pursue this potential alternative.

The commercial value of this kind of product is not likely to be such that it could carry high processing costs. The concept of the alternative processing method and the subsequent evaluation of the commercial application of the resulting product may be warranted.

3.0 MATERIAL PROCESSING - DESCRIPTION OF PROCESS

Part of each of the samples, identified as ASL#1, ASL#2 and ASL#2A lenticular, were first dried to determine the moisture content of each of the "as received" samples.

3.1 DISPERSION

This was followed by dispersing 3000 grams of the wet clay in 20 litres of water to which was added 50 ml. of a 100 gram/litre solution containing 33.0% sodium carbonate and 67% commercial grade Calgon. The slurries were agitated for 2 hours to break up lumps and fully disperse the material.

3.2 SCREENING AT 325 MESH

Following dispersion the resulting slurry was screened at 325 mesh, using an 18" Sweco vibratory screen equipped with a 325 mesh (45 micron) screen.

3.3 FLOCCULATION - SETTLING - FILTRATION

The oversize material was filtered and dried while the -325 mesh (45 micron) containing slurry was treated with sulphuric acid to a pH of 2.6 followed by addition of 0.2% by weight of aluminum sulphate based on the weight of the dry sample.

The slurry did not flocculate at all, partially because the sulphuric acid reacted with an acid soluble component, resulting in the pH gradually increasing back to neutral.

Addition of commercial grades of either anionic or cationic organic flocculants, made by Allied Colloids, did not result in better flocculation and settling rate.

This necessitated allowing the slurries to stand undisturbed for a significant time period to facilitate settling. Following extended settling the clear supernatant solution was siphoned off and the settled slurry containing the -325 mesh fraction, transferred to a vacuum filter.

It became evident that vacuum filtration was totally ineffective and therefore the slurry was transferred to an 8" diameter Denver pressure filter.

Initially it was attempted to conduct the pressure filtration at a pressure of 40 $lb/inch^2$. Because of the slow filtration rate pressure was increased to 80 $lb/inch^2$. Despite this high pressure employed it required up to 48 hours to complete filtration.

The filter cake was dried and percentages of +325 mesh (45 micron) and -325 mesh calculated for each of the three samples.

The dried -325 mesh fractions were analyzed for their chemical composition. One of the samples was also analyzed by X-ray diffraction. Based on this and the chemical composition a modal analysis was done to obtain an approximation of the mineral composition.

Table #1 outlines the chemical analysis of the "as received" dried material and the -325 mesh fraction. It also gives the percentages of moisture (H_2O) in the "as received" samples, the calculated percentages of coarse +325 mesh sand and the -325 kaolin containing fine fraction.

Table #2 gives calculated percentages of kaolin present in the -325 mesh fraction as determined by modal analysis.

TABLE #1

CHEMICAL COMPOSITION OF "AS RECEIVED" SAMPLES AND THE -325 MESH FRACTION EXTRACTED

ELEMENT	ASL-1 CRUDE	ASL-1 -325M.	ASL-2 CRUDE	ASL-2 -325M.	ASL-2A CRUDE	ASL-2A -325M.
SiO_2	77.20	63.50	74.10	70.20	74.50	75.20
Al_2O_3	13.50	22.20	13.90	15.90	15.00	14.60
CaO	0.10	0.10	0.23	0.10	0.16	0.19
MgO	0.43	0.71	0.50	0.54	0.63	0.63
Na_2O	0.10	0.21	0.14	0.19	0.16	0.16
K_2O	1.90	3.80	2.17	2.52	2.72	2.60
Fe_2O_3	1.10	1.56	2.42	2.78	1.30	1.28
MnO	0.01	0.01	0.01	0.01	0.01	0.01
TiO_2	0.71	0.92	0.90	0.93	0.80	0.78
L.O.I.	4.97	7.37	5.49	6.68	4.62	4.32

% MOISTURE IN "AS RECEIVED" SAMPLES

ASL-1 11.82% – Sample from the foot wall area from the conveyor belt
ASL-2 17.25% – partially dried sample from bench
ASL-2A 1.7% – working face – lenticular clay within Cgl.

	% +325 Mesh	% -325 Mesh
ASL-1	45.26	54.74
ASL-2	20.02	79.98
ASL-2A	26.52	73.48

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4.0 MODAL ANALYSIS

Modal calculations are based on the chemical composition and the X-ray diffraction analysis interpretation as conducted on sample ASL-2A -325 mesh fraction. This X-ray diffraction pattern indicated the presence of quartz-kaolin-muscovite and sericite micas and possibly illite. No feldspar was noted. It is therefore assumed that the K_2O content of the material is attributable to micas. This makes an accurate modal analysis difficult because the chemical composition of micas can be quite variable. Also since both kaolin and micas contain alumina and water of crystallization, the L.O.I. or Al_2O_3 content cannot be attributed to kaolin alone.

It was assumed the mica was of the muscovite variety and its theoretical composition was used to first calculate mica content of the samples, followed by kaolin and quartz. Because of this the calculated percentages are "approximate" only.

TABLE #2

CALCULATED MINERAL PERCENTAGES IN -325 MESH FRACTION

	ASL-1	ASL-2	ASL-2A
Kaolin	24.80	19.40	15.50
Mica	32.20	21.40	21.00
Quartz	37.40	51.50	58.00
Other	5.60	7.70	5.50

It is difficult to believe that so little kaolin is present in the samples. It is possible that the assumption that K_2O can all be contributed to muscovite mica is not correct. However, the X-ray diffraction pattern does not show any feldspars or other minerals containing K_2O.

The results do clearly establish that the particle size of the silica (quartz) strongly overlaps the size distribution of the other minerals. For this purpose it was decided to process the -325 mesh size fraction by further size fractionation.

5.0 FRACTIONATION AT 10 MICRON

The -325 mesh material was thoroughly dispersed in water and sodium-hexametaphosphate and allowed to settle. Following a predetermined settling time (calculated on the basis of Stokes Law of Sedimentation) the solution containing the suspended -10 micron material was siphoned off. The residue was again dispersed and a second sedimentation test done. Again the solution fraction with the -10 micron still in suspension was drawn off and combined with the first -10 micron fraction.

The final residue was filtered using pressure filtration. The -10 micron fraction was treated with alum and sulphuric acid and allowed to settle for 3 days. This was followed by siphoning off the clear supernatant and pressure filtration at 80 $lb/inch^2$ of the settled slurry.

Filtration was exceedingly slow, requiring up to 48 hours. The filter cake was dried and from the dry weight the percentages of -325 10 micron and -10 micron calculated.

The following results were obtained:

	% -45 x 10 micron	-45 x -10 micron
ASL-1	26.50%	73.50%
ASL-2	39.50%	60.50%
ASL-2A	21.00%	79.00%

These percentages are calculated on the basis of -325 mesh = 100%. Calculated on the basis of original crude feed material the percentages are as follows:

	% +325mesh	% -325 +10 micron	% -10 micron
ASL-1	45.26	14.50	40.24
ASL-2	20.02	31.58	48.40
ASL-2A	26.50	15.45	58.03

6.0 ANALYSIS OF -10 MICRON MATERIAL

Each of the -10 micron products were analyzed by X-ray fluorescence. X-ray diffraction analyses were done to obtain data on the mineral constituents of the samples. This was further developed by modal analysis based on chemical composition and minerals identified by X-ray diffraction.

Particle size analyses were conducted using the Sedigraph 5000 particle size analyzer.

Fired colour was done by firing samples of the -10 micron at 1000^{o}C for one hour.

Brightness was determined on the -10 micron before and after chemical bleaching. This was done by the tri-stimulus method.

Determination of low shear viscosity by Brookfield viscometer could not be performed. Even at 50% solids the resulting slurry was extremely viscous due to the high plasticity of the clay.

Chemical analyses of the -10 micron fractions are given in Table #3.

TABLE #3
CHEMICAL COMPOSITION OF -10 MICRON MATERIAL

	Sample #		
ELEMENT	ASL-1 -10 m.	ASL-2 -10 m.	ASL-2A -10 m.
SiO_2	58.00	59.10	58.60
Al_2O_3	25.20	22.70	23.70
CaO	0.29	0.33	0.25
MgO	0.89	0.80	1.02
Na_2O	0.14	0.22	0.18
K_2O	3.67	3.64	4.20
Fe_2O_3	1.96	4.36	1.99
MnO	0.01	0.01	0.01
TiO_2	0.81	0.92	0.85
L.O.I.	8.74	7.63	9.08

In comparing the analysis of the finer than 10 micron material with the -325 mesh (45 micron) it is clear that there is a reduction in total SiO_2, an increase in Al_2O_3, K_2O and Fe_2O_3 and L.O.I.

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6.1 X-RAY DIFFRACTION ANALYSIS

Each of the three finer than 10 micron samples were analyzed by the X-ray diffraction technique. Interpretation of the XRD patterns (see appendix) indicated the presence of kaolin quartz, mica and possibly illite. X-ray intensities were generally poor and due to the complexity of the pattern it is difficult to be precise in interpreting. It is possible that besides mica there is some potassium feldspar, however it could not be positively identified.

6.2 MODAL ANALYSIS

On the basis of the XRD interpretation and the chemical composition a modal analysis was made First the amount of mica was calculated on the basis of the theoretical composition of muscovite mica. This was followed by calculating the kaolin content based on the residual amount of Al_2O_3 following the mica calculation. Any SiO_2 remaining was then attributed to quartz. These calculations are only approximate. The chemical composition of muscovite mica is highly variable, particularly it is not known how the Fe_2O_3 is distributed in the micas or kaolin or other associated minerals.

A second modal analysis was made, assuming that feldspar (microcline) was also present. However, neither chemical analyses nor the X-ray diffraction analysis provide any factual data as to the amount of each. Therefore the actual mineralogical composition is somewhere between the modal analysis based on mica and the modal analysis based on microcline feldspar. In actuality it is clear that the kaolin, even at 10 micron, is not very pure and that further separations are likely to results in products of improved quality.

The following results were obtained:

MODAL ANALYSES BASED ON MUSCOVITE MICA AS THE PRIMARY IMPURITY

	Muscovite %	Kaolin %	Quartz %	Other %
ASL-1 -10 micron	31.1	33.5	28.4	6.8
ASL-2 -10 micron	30.8	27.4	32.4	8.2
ASL-2A -10 micron	35.6	25.3	30.7	8.2

MODAL ANALYSES BASED ON MICROCLINE FELDSPAR AS THE PRIMARY IMPURITY

	Microcline %	Kaolin %	Quartz %	Other %
ASL-1 -10 micron	21.7	53.7	18.0	5.3
ASL-2 -10 micron	21.2	47.4	23.1	7.6
ASL-2A -10 micron	24.9	48.4	20.0	6.6

As noted, the modal analyses are not conclusive as it is impossible to determine from the X-ray diffraction patterns what the relative percentages of each mineral are in the samples. There is a significant difference in the calculated amount of kaolin between the two analyses. It is the author's opinion that the "true" composition is somewhere in between with each sample containing undetermined amounts of both muscovite micas as well as weathered microcline feldspar. Quartz is present in significant amounts. This by itself makes this material unsuitable for all but the most mundane commercial applications. The difficulties encountered during processing make even these doubtful.

6.3 PARTICLE SIZE ANALYSIS

Particle size analyses were conducted using the Sedigraph 5000 particle size analyzer. Results show these samples to be very fine. The separation at 10 micron was quite efficient as in each case the samples were virtually 100% finer than 10 micron.

Results are given in tabular form. The actual particle size graphs are included in the appendix.

Results show the following:

SIZE	ASL-1 -10 m. % finer	ASL-2 -10 m. % finer	ASL-2A -10 m. % finer
10 micron	99	99	100
8	98	97	99
6	96.5	94	97
5	94	92	96.5
4	92	89	95
3	88	83	92
2	83	76	87
1	76	71	79
0.8	73	65	77
0.6	65	56	71
0.5	59	52	66

6.4 FIRED COLOUR

Each of the three -10 micron samples were fired at 1000^{o}C for 1 hour in order to obtain a measure of the fired colour. In each case the samples fired to an orange/brown colour, undoubtedly caused by the high iron content. Samples of the fired material accompany this report as are samples of the -325, 325 x 10 micron and -10 micron.

6.5 DRY BRIGHTNESS

While it was obvious that the samples exhibit a low dry brightness (whiteness) the actual brightness values were determined by the tri-stimulus method, where the brightness, whiteness and yellowness is calculated from the reflections obtained through three narrow band pass filters, one a blue filter, one an amber and a green filter.

Using this method, paper coating or filler grade kaolins typically show brightness in the range of 92-93%. It must be noted that the scale is logarithmic rather than linear. Therefore a brightness of 85 is several orders of magnitude darker than a 95 brightness.

6.5.1 BLEACHING OF -10 MICRON

The brightness was determined on the natural -10 micron material and after bleaching at a pH of 2.6 (sulphuric acid) and the equivalent of 2 lb/tonne of sodium dithionite. This bleaching had very little effect on brightness.

Results on unbleached and bleached are given on table # 4.

TABLE # 4

	DRY BRIGHTNESS	WHITENESS	YELLOWNESS INDEX
ASL-1 -10	81.6	84.9	0.17
ASL-1 -10 BLEACHED	83.3	85.7	0.14
ASL-2 -10	68.6	65.1	0.23
ASL-2 -10 BLEACHED	77.2	66.5	0.23
ASL-2A -10	78.8	75.3	0.22
ASL-2A -10 BLEACHED	79.9	76.3	0.22

6.6 LOW SHEAR VISCOSITY

Highly crystalline paper grade kaolin has very good rheological properties. A dispersed 70% solids suspension typically has the consistency of cream. Comparatively ball or fire clays, which typically exhibit poor crystallinity, are highly plastic at the same solids dispersant content.

Prepared 70% solids and dispersed slurries from all three samples were like stiff mud. At 66% it could just be mixed while at 50% solids it had the consistency of thick paint. At 50% solids the viscosity was in excess of 10,000 centipoise.

From this it can be concluded that the material as represented by the -10 micron fraction is a non-typical clay, being more like a ball or fire clay. The mineralogical composition also indicates the clay to be mixed with micas, fine quartz and possibly residual weathered potassium feldspar.

7.0 CONCLUSIONS

Based on results obtained it must be concluded that the kaolin bearing sands as submitted are difficult to process, particularly where this relates to flocculation and subsequent filtering.

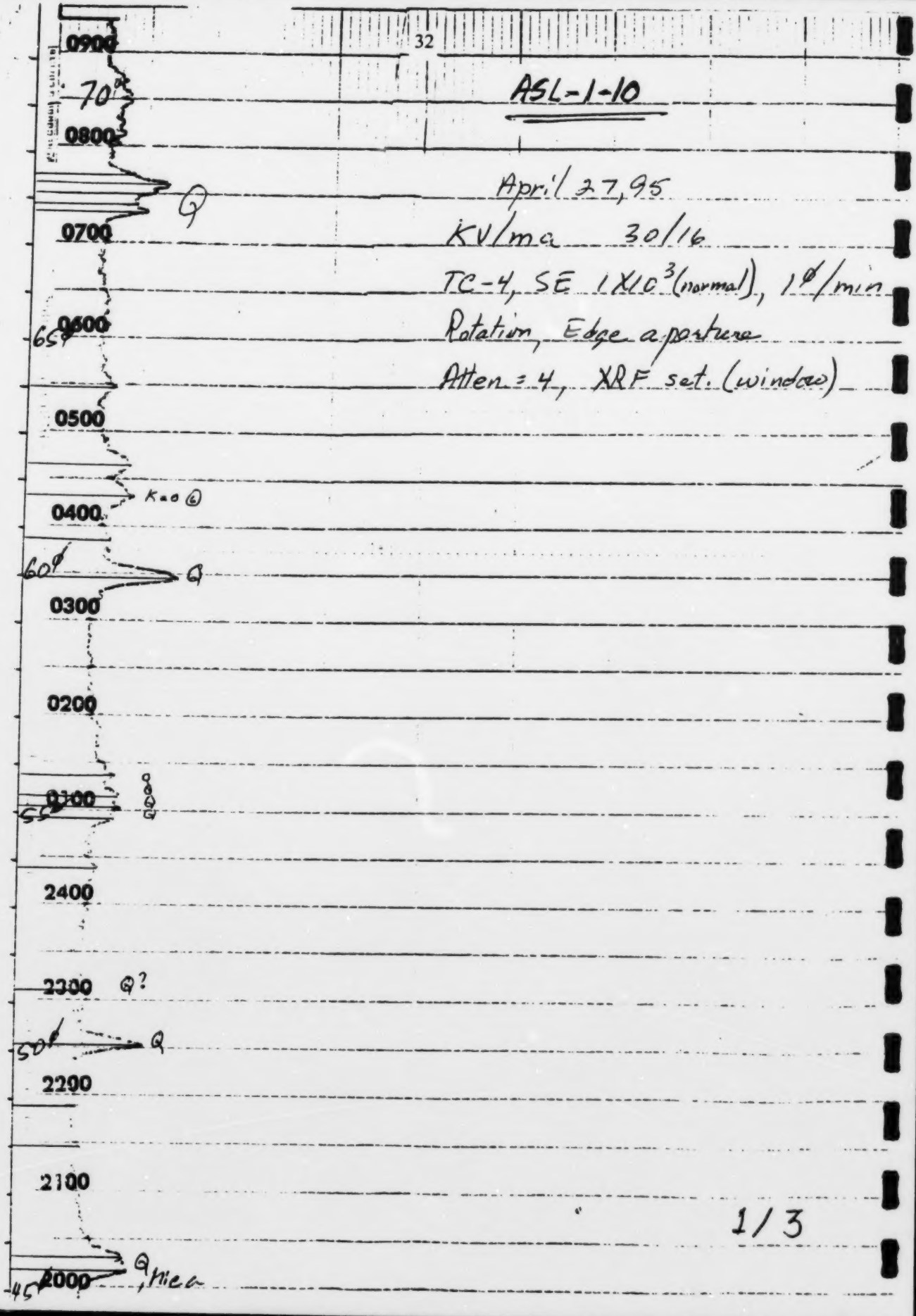
The kaolin at either -325 mesh (45 micron) or at 100% -10 micron is a mixture of kaolin, micas and fine quartz that could not be separated.

The material shows a similar degree of plasticity as fire clays or ball clays. However, it is not clear if the thermal properties are similar.

It is difficult on the basis of obtained results to suggest any possible commercial utilization, with the exception of use in brick making or in production of clay pots etc.

The processing difficulties as encountered suggest that processing these types of materials may not be economic, unless these difficulties can be overcome by further detailed testing and development work.

The one possible alternative that could be evaluated is the dry processing of any kaolinitic lenses contained in the deposit. Drying and grinding of the kaolinitic matrix, to break the sand to its natural grain size followed by air classification, may have some merit. This should only be undertaken if it can be clearly demonstrated that the resulting products have commercial potential.



ASL-1-10

April 27, 95

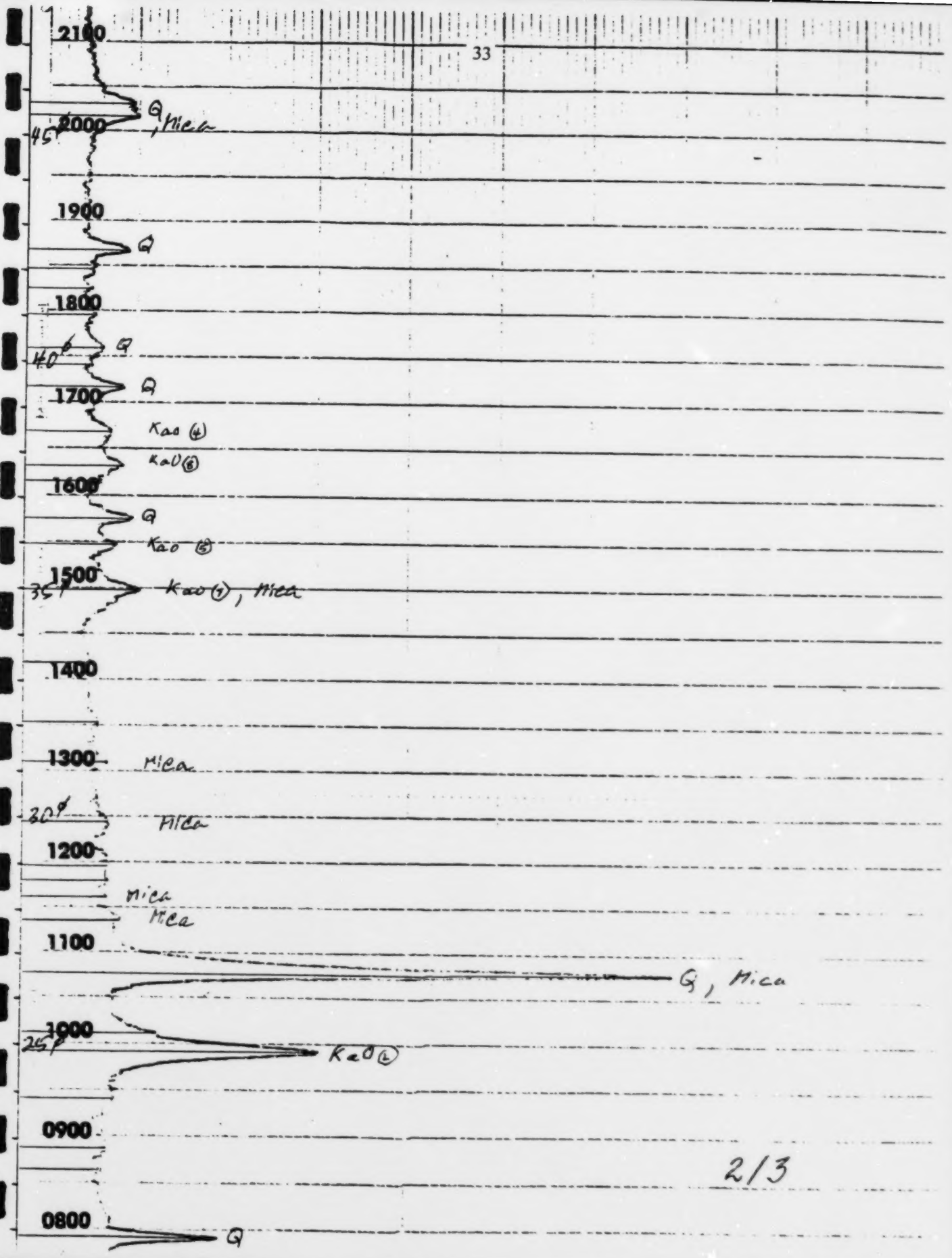
KV/ma 30/16

TC-4, SE 1×10^3 (normal), 1°/min

Rotation, Edge aperture

Atten = 4, XRF set. (window)

1/3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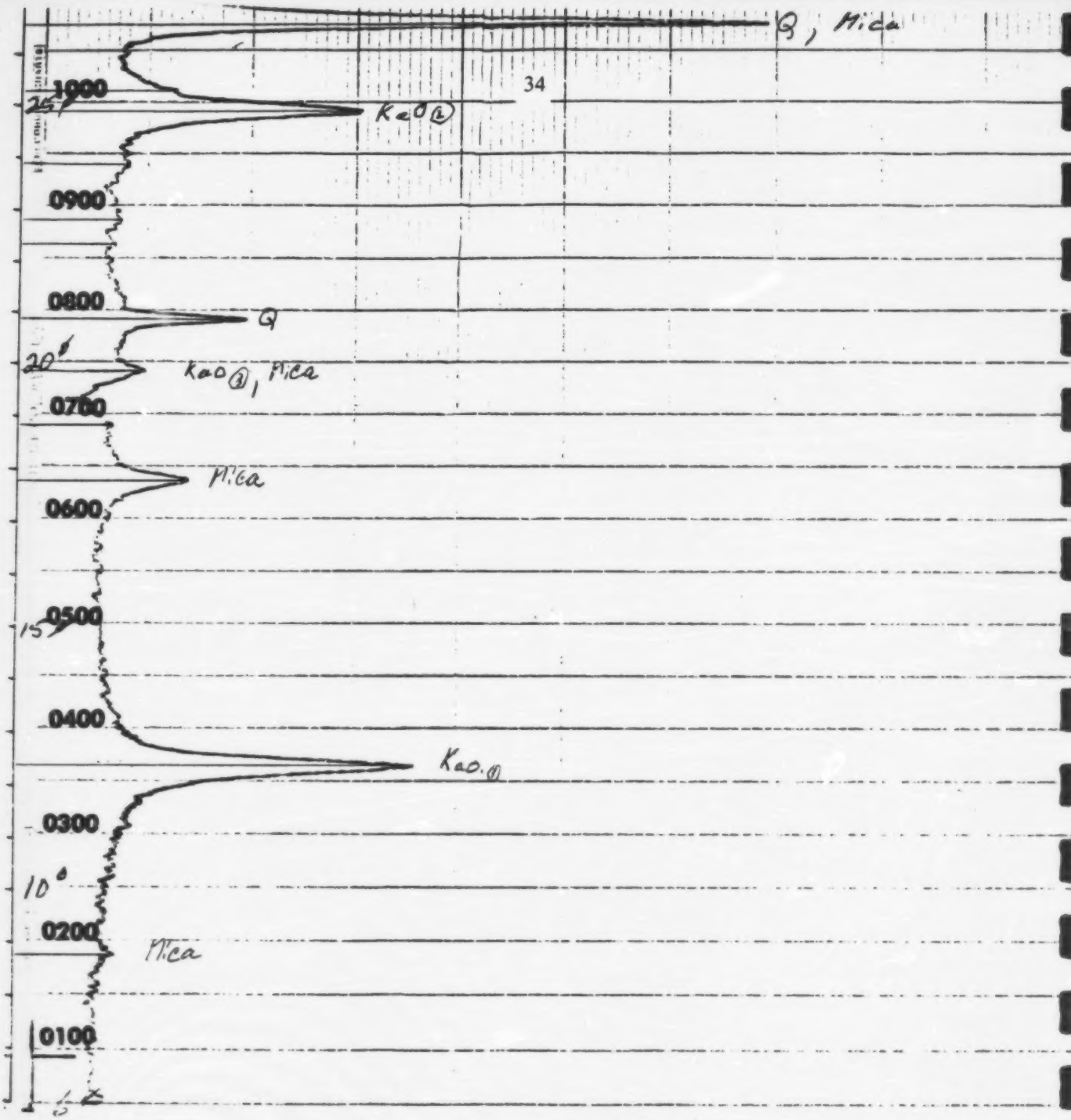
Q, Mica
45
2000
1900
Q
1800
Q
40
Q
1700
Kao (4)
Kao (6)
1600
Q
Kao (5)
1500
35
Kao (4), Mica
1400
1300
Mica
20
Mica
1200
Mica
Mica
1100
Q, Mica
1000
25
Kao (2)
0900
0800
Q

213



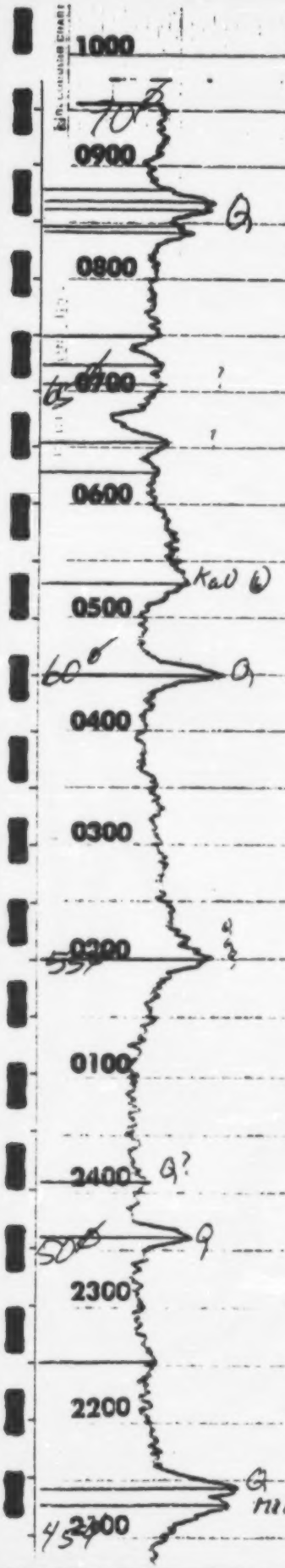
ASL-1-10 April 27, 95

KV/ma 30/16

TC-4, SE 1×10^3 (normal), 1°/min

Rotation, Edge aperture

Atten = 4, XRF set. (windaq)



April 27 '95

ASL-2-10

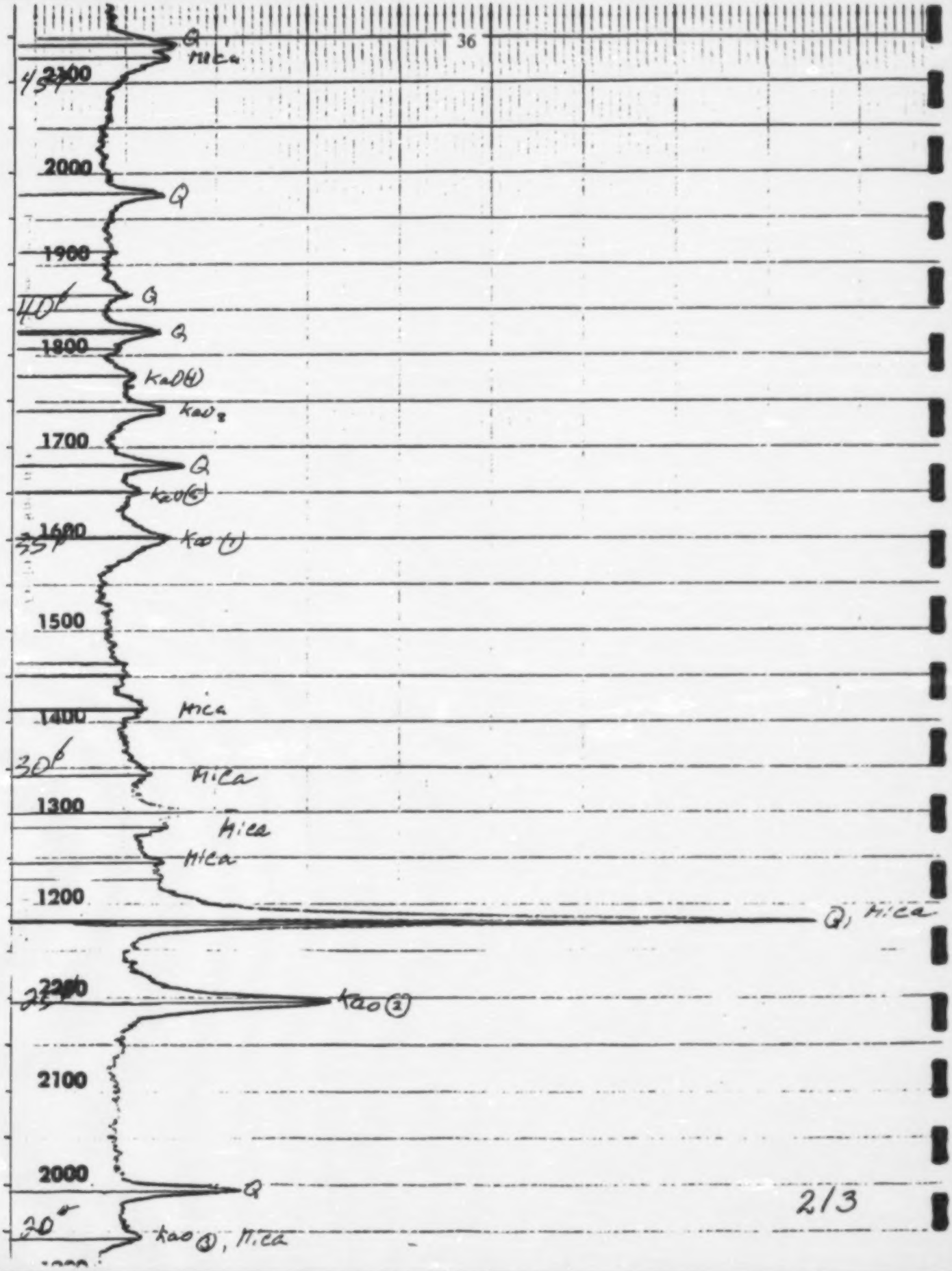
IHD 94339 KV/ma 30/16

TC-4, S.E. 1X10³ (normal) 1°/min

Rotation, Edge aperture

Attenuation = 4, XRF-setting (windows)

1/3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Mica
2300
2000
Q
1900
Q
Q
1800
Kaol(1)
Kaol(2)
1700
Q
Kaol(3)
1600
Kaol(4)
1500
Mica
1400
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1300
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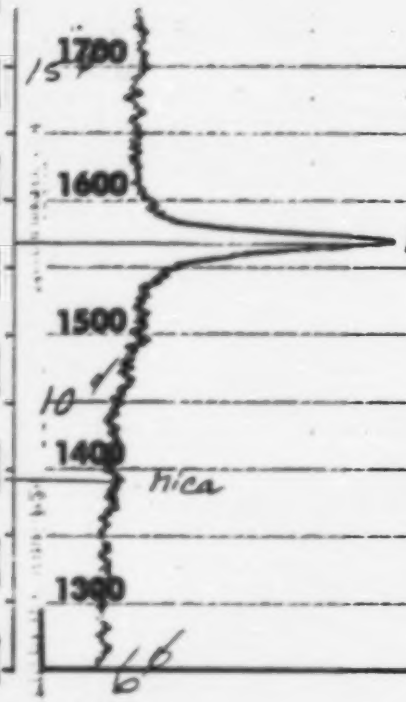
Q, Mica
2200
Kaol(2)
2100
2000
Q
Kaol(3), Mica

213



April 27'95

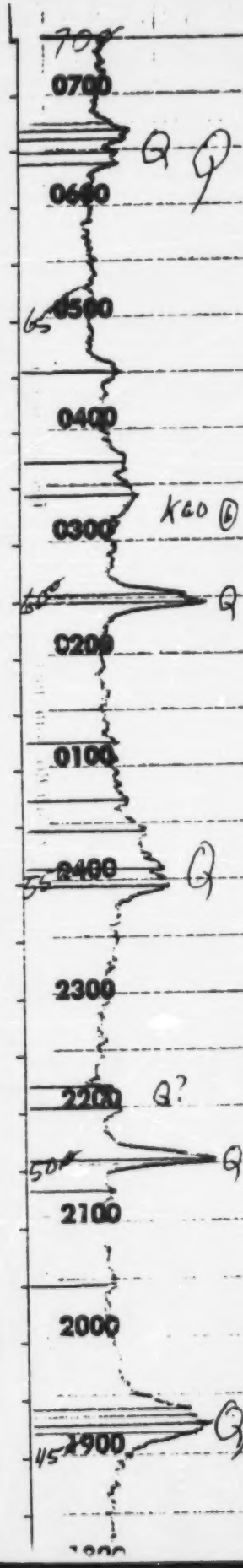
ASL-2-10

IMO 94339 KV/ma 30/16

TC-4, SE 1X10^3 (normal) 1°/min

Rotation, Edge aperture

Attenuation = 4, XRF-setting (windows)



ASL-2A-10 May 2'95

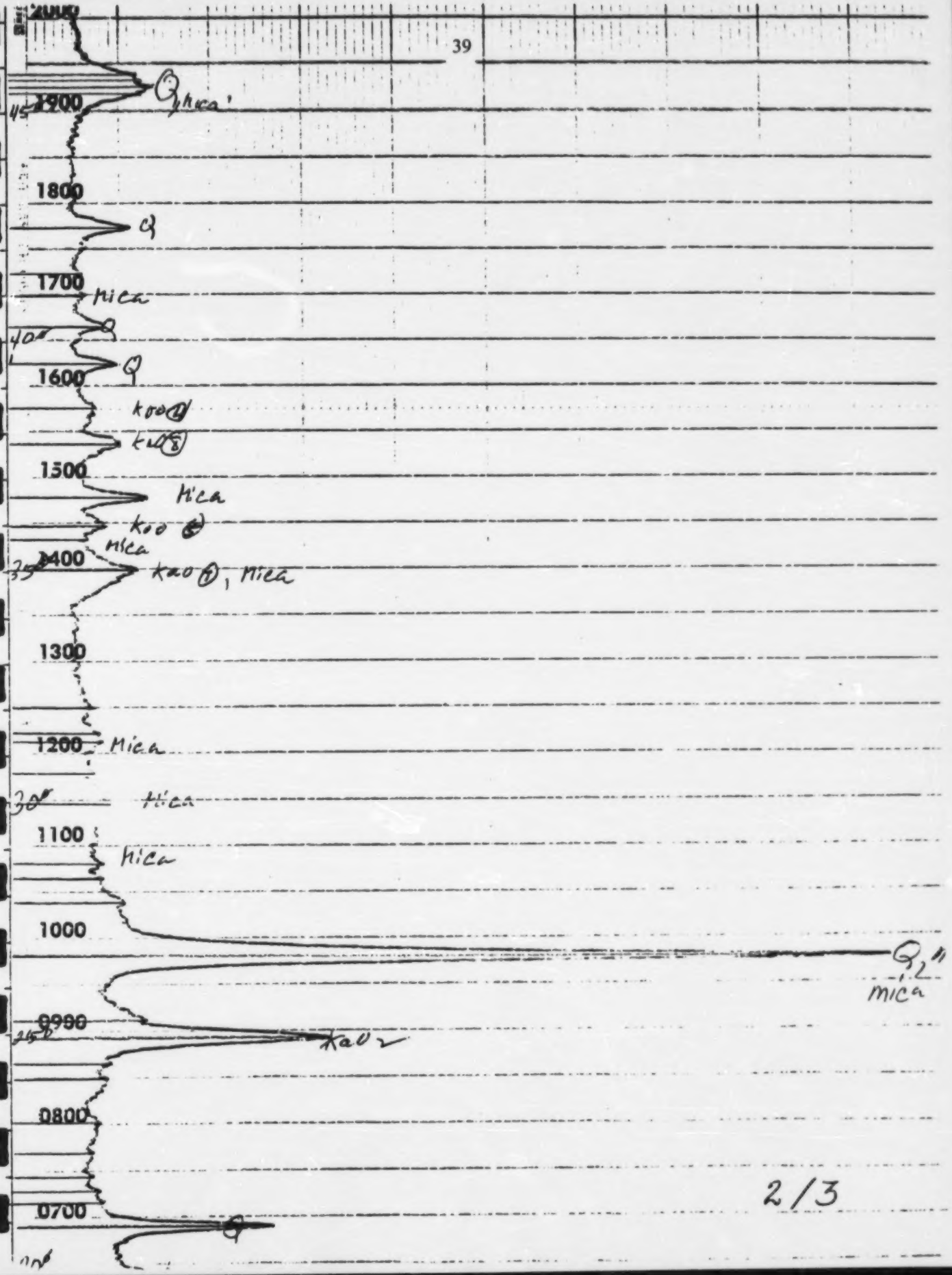
KV/ma 30/16

TC=4, SE 1X10^3 (normd) 1°/min

Rotation, Edge aperture

Attenuation=4, XRF Setting (window

1/3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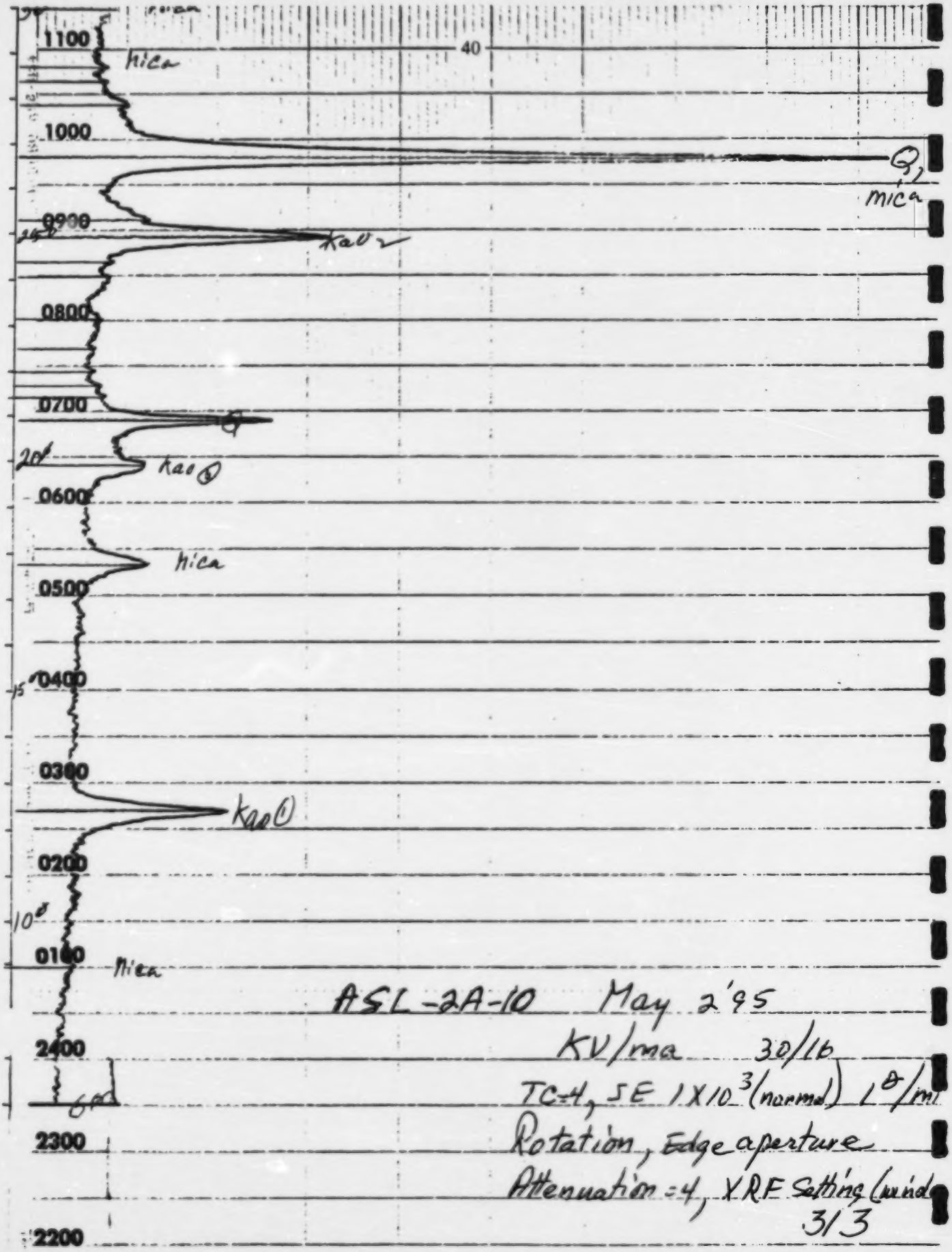
mica
0900
kao
0800
0700
Q

2/3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1000
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0400
0300
0200
0100
2400
2300
2200
40
mica
Q
mica
kaol
kaol
mica
kaol
mica
ASL-2A-10 May 2'95
KV/ma 30/16
TC-4, SE 1X10^3 (normd) 1^0/int
Rotation, Edge aperture
Attenuation=4, XRF Setting (wind
313

PARTICLE SIZE DISTRIBUTION

SAMPLE IDENTIFICATION 94339 ASL #1

Density 2.74 g/cc Liquid

Preparation

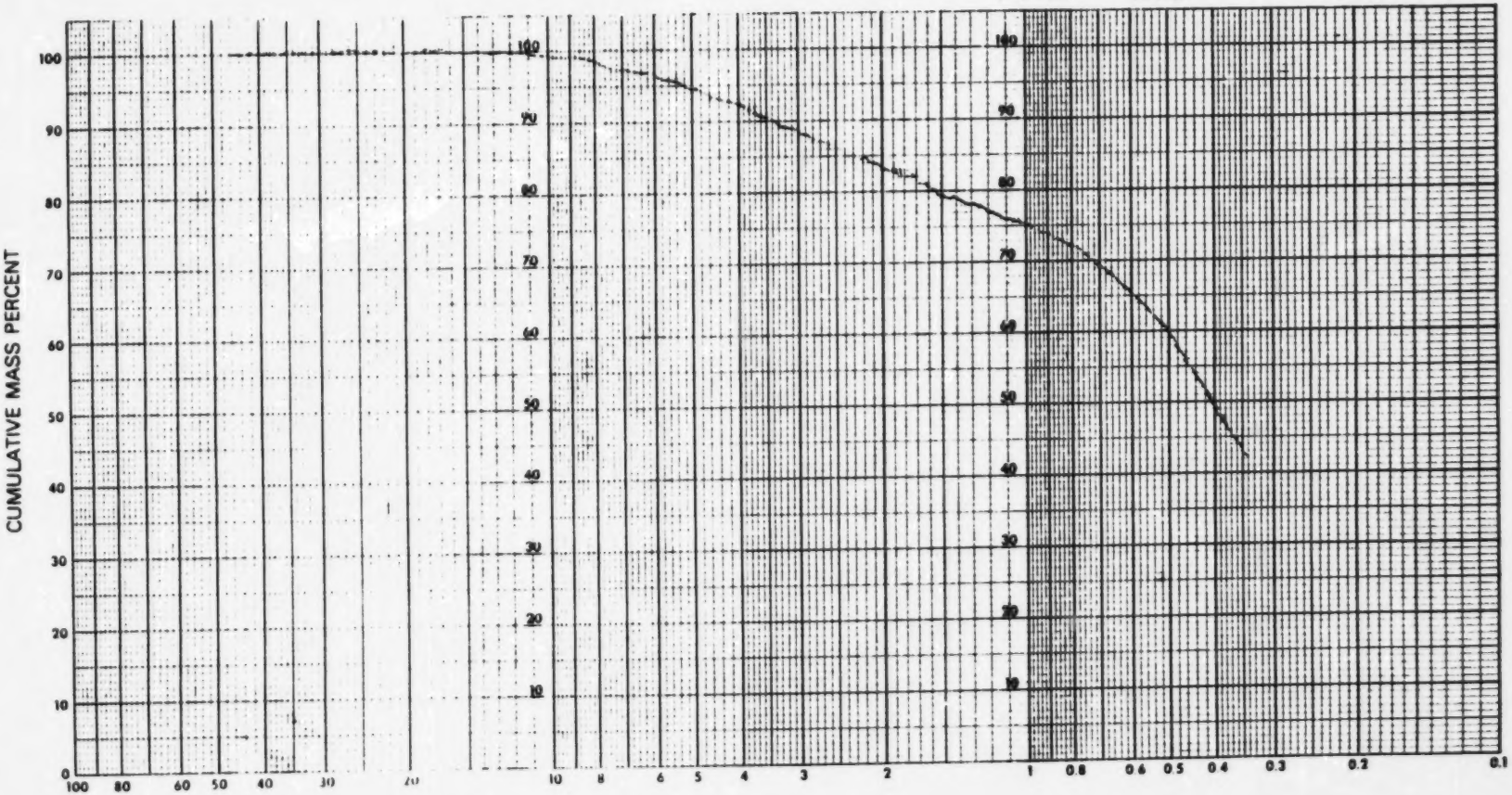
Density .9960 g/cc Viscosity .8180 cp

DATE

BY

TEMPERATURE 29 °C

RATE 452 START DIA 50 µm



micromeritics

PARTICLE SIZE DISTRIBUTION

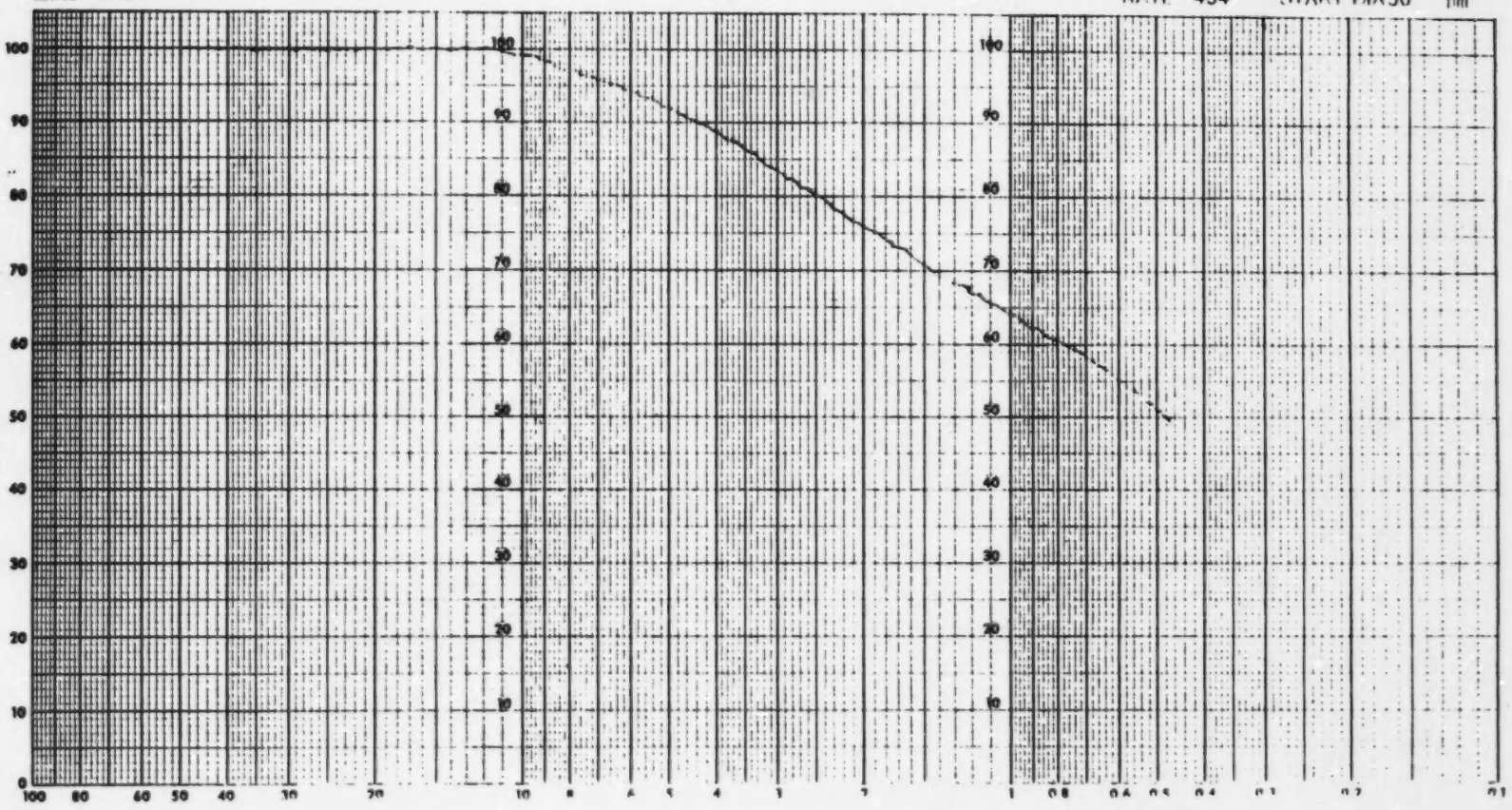
SAMPLE IDENTIFICATION 94339 ASL #2

DATE

Density 2.79 g/cc LIQUID Density .9968 g/cc · Viscosity .8737 cp BY

Preparation TEMPERATURE 26 °C

RATE 434 START DIA 50 μm



EQUIVALENT SPHERICAL DIAMETER, μm

micromeritics
instrument corporation

Form 500/42701

PARTICLE SIZE DISTRIBUTION

SAMPLE IDENTIFICATION 94339 ASL #2A

Density 2.75 g/cc Liquid

Preparation

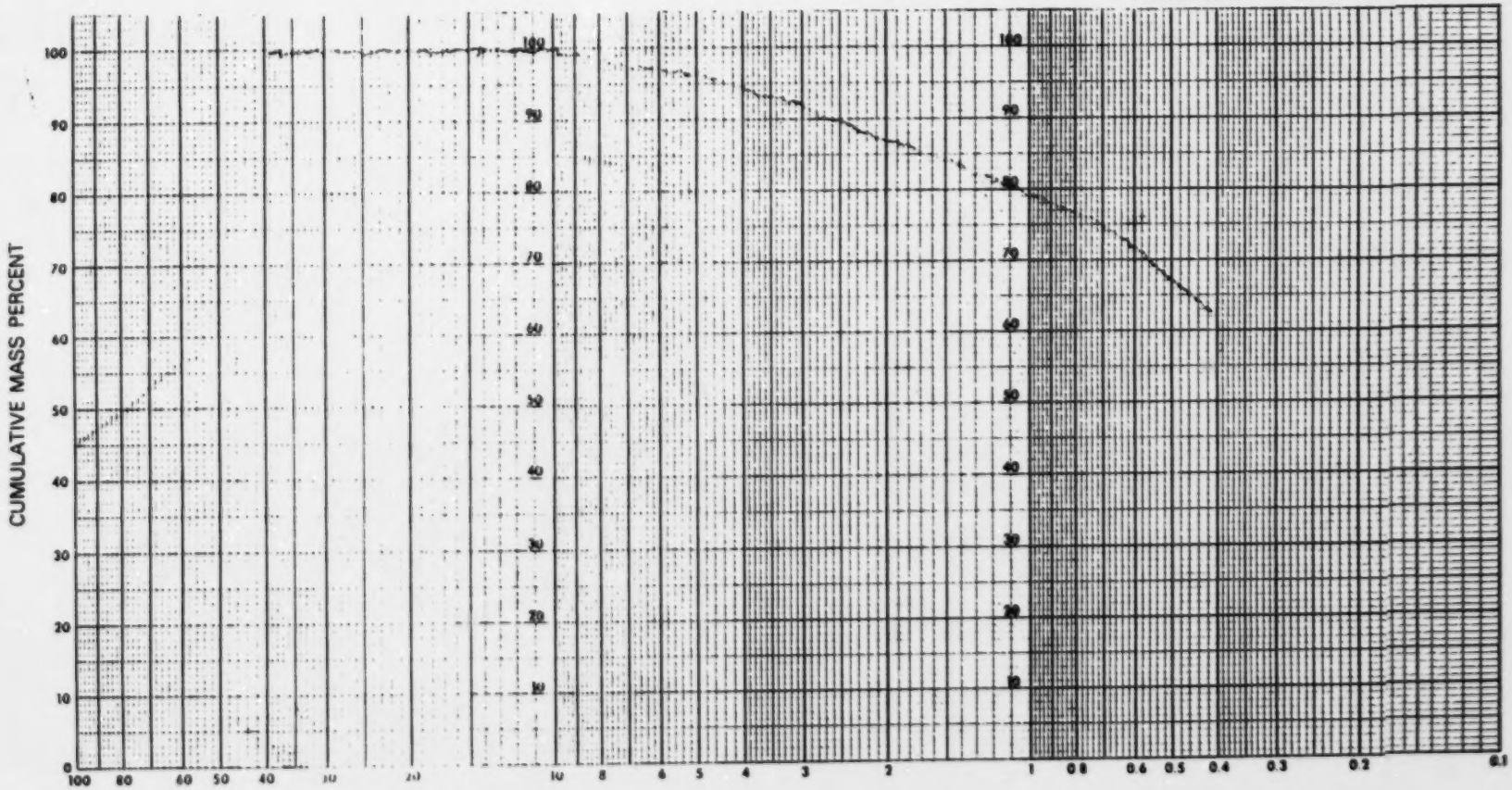
Density .9954 g/cc Viscosity .7840 cp

DATE

BY 31°

TEMPERATURE 31 °C

RATE 474 START DIA. 50 µm



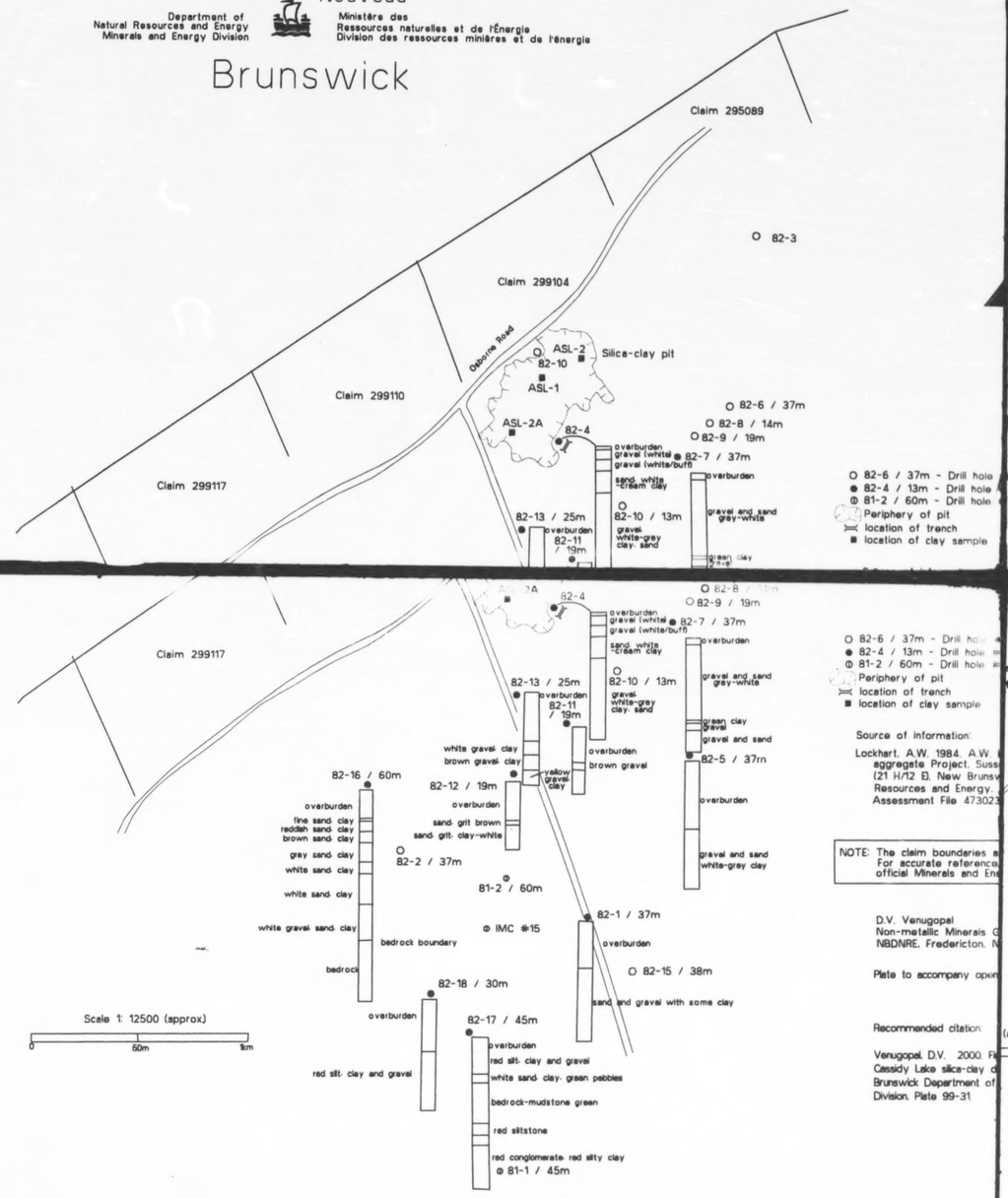
micromeritics

New Nouveau

Department of Natural Resources and Energy
Minerals and Energy Division

Ministère des Ressources naturelles et de l'Énergie
Division des ressources minières et de l'énergie

Brunswick



○ 82-6 / 37m - Drill hole
● 82-4 / 13m - Drill hole
⊕ 81-2 / 60m - Drill hole
Periphery of pit
location of trench
■ location of clay sample

Source of information:

Lockhart, A.W. 1984. A.W. Lockhart Sussex Silica and aggregate Project, Sussex, New Brunswick, Canada. (21 H/12 E). New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division. Assessment File 473023

NOTE: The claim boundaries are provided for purposes of convenience only. For accurate reference, recourse should be made to official Minerals and Energy Division files.

D.V. Venugopal
Non-metallic Minerals Geologist
NBDNRE, Fredericton, N.B.

Plate to accompany open File 99-13.

Recommended citation:

Venugopal, D.V. 2000. Figure 3. Drill hole location and drill hole information, Cassidy Lake silica-clay deposit, New Brunswick (part of NTS 21 H/12). New Brunswick Department of Natural Resources and Energy, Mineral and Energy Division, Plate 99-31.

Figure 3. Drill hole location and drill hole information, Cassidy Lake silica-clay deposit, New Brunswick (part of NTS 21 H/12)

MP 99-31

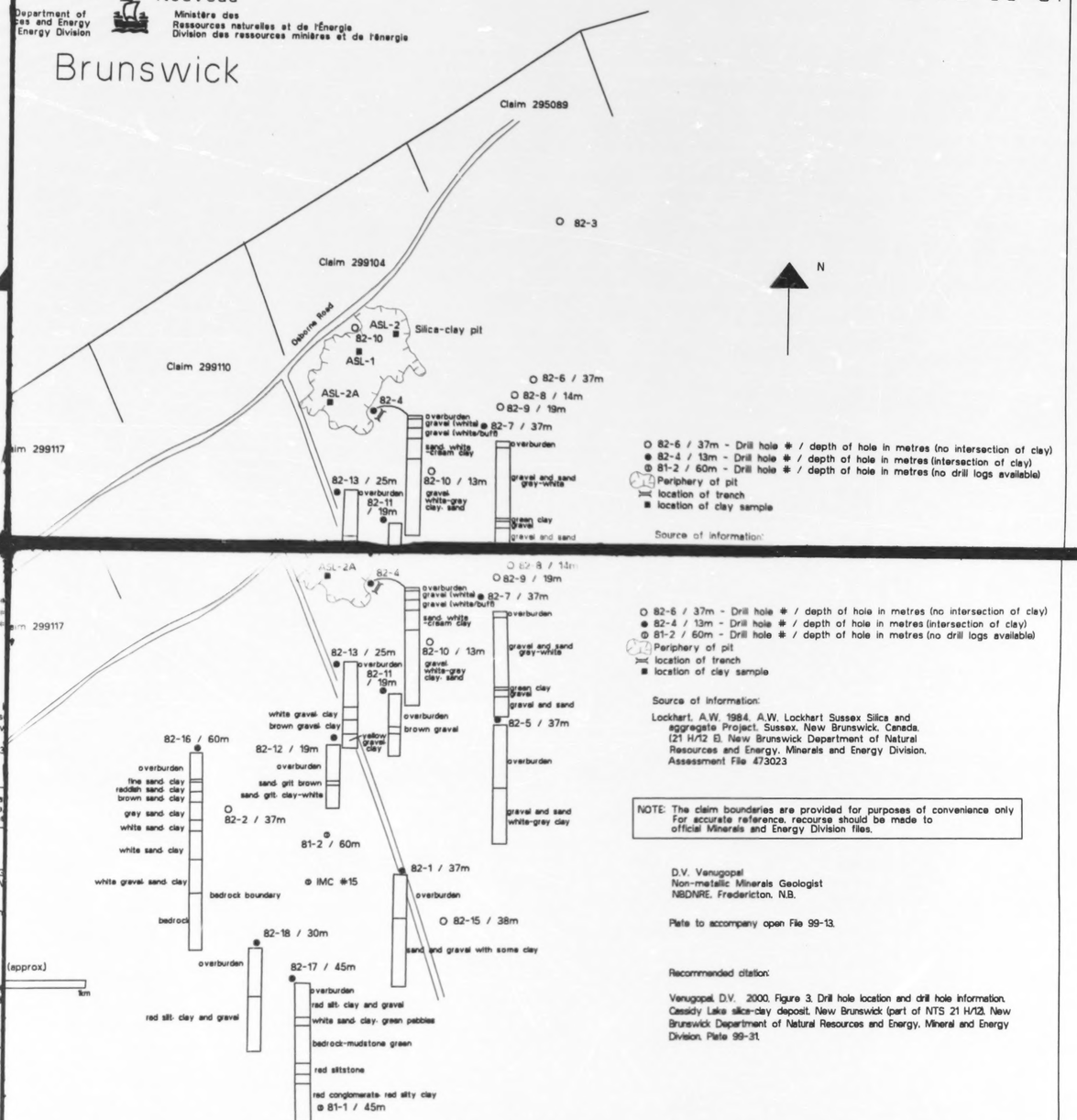
PLATE 99-31

New Nouveau

Department of Natural Resources and Energy
Energy Division

Ministère des Ressources naturelles et de l'Énergie
Division des ressources minières et de l'énergie

Brunswick



○ 82-6 / 37m - Drill hole # / depth of hole in metres (no intersection of clay)
● 82-4 / 13m - Drill hole # / depth of hole in metres (intersection of clay)
⊕ 81-2 / 60m - Drill hole # / depth of hole in metres (no drill logs available)
Periphery of pit
location of trench
■ location of clay sample

Source of information:

Lockhart, A.W. 1984. A.W. Lockhart Sussex Silica and aggregate Project, Sussex, New Brunswick, Canada. (21 H/12 E). New Brunswick Department of Natural Resources and Energy, Minerals and Energy Division. Assessment File 473023

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